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# DOE/NASA CONTRACTOR REPORT

DOE/NASA CR-150589

## SOLAR HEATING AND COOLING SYSTEMS (Quarterly and Monthly Reports)

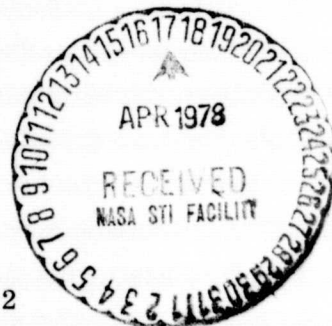
Prepared by

Solar Engineering and Equipment Company  
3305 Metairie Road  
Metairie (New Orleans), LA 70001

Under Contract NAS8-32247 with

National Aeronautics and Space Administration  
George C. Marshall Space Flight Center, Alabama 35812

For the U. S. Department of Energy



(NASA-CR-150589) QUARTERLY AND MONTHLY  
REPORTS FOR SOLAR HEATING AND COOLING  
SYSTEMS Progress Report, 30 Sep. 1976 - 30  
Sep. 1977 (Solar Engineering and Equipment  
Co.) 29 p HC A03/MF A01

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# U.S. Department of Energy



## Solar Energy

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15. SUPPLEMENTARY NOTES This work was done under the technical management of Mr. Valmore Fogle, George C. Marshall Space Flight Center, Alabama.			
16. ABSTRACT  This document is a collection of six monthly reports and one quarterly report from Solar Engineering and Equipment Company (SEECO), covering the progress of work from September 30, 1976, through September 30, 1977. SEECO, under NASA/MSFC Contract NASS-32247, is developing two prototype solar heating systems consisting of the following subsystems: collector, control, and storage.  These reports have been reformatted and the pages renumbered. A limited amount of retyping has been done for legibility and for removal of cost information.			
17. KEY WORDS		18. DISTRIBUTION STATEMENT Unclassified-Unlimited  <i>William A. Brooksbank Jr.</i> WILLIAM A. BROOKSBANK, JR. Manager, Solar Heating & Cooling Project Ofc.	
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## MONTHLY STATUS REPORT

PERIOD: SEPT. 30, 1976 - OCT. 31, 1976

TO: Belton Jones, Jr.  
Contracting Officer  
Att.: AP 32  
Marshall Space Flight Center  
Alabama 35812

Report No. 1

Nov. 2, 1976

Contract NAS 8 32247

### PART I

#### SUMMARY

All of the required data and drawings have been completed and sent to NASA for review and evaluation. This material for the most part is the data that will be discussed at the preliminary design review scheduled for Nov. 26, 1976. However, because this is the day after Thanksgiving we have submitted a request to change the date to Nov. 22, 1976. We have also requested the meeting be held in St. Louis, MO at the office of the Binkley Co. As of this date we have not received a reply to this date change request. All of the material required for the preliminary design review have been transmitted within the required two weeks prior to this review meeting.

### PART II

#### CONTRACT STATUS

There has been no change in the contract status. We should be advised at the Preliminary Design Review of the site location and given other pertinent data to prepare a proposal for a contract change for the installation of the prototypes I & II.

### PART III

#### SCHEDULES

Development Plan: A change has been submitted to the Contracting Officer to change the scheduled date of Nov. 26, 1976 for the Preliminary Design meeting to Nov. 22, 1976. This change in date has been proposed because of the Thanksgiving holiday, Nov. 25. We have also requested the location of this meeting be at the Binkley Company's office in Warrenton, MO. This location will afford easier clarification of some of the data dealing with quality control and manufacturing processes.

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Verification Plan: The verification plan has been updated and submitted for review and should be discussed at the Preliminary Design Review meeting November 22.

Quality Control Plan: The quality control plan has been updated and expanded and will be discussed at the Preliminary Design meeting.

Plans & Specifications: Fourteen (14) pages of design drawings have been completed and submitted and will be discussed at the Preliminary Design meeting. The specifications involving the installation of the systems have not yet been prepared in detail as the actual site location will govern the contents of these specifications. A request for drawings and other requirements and data regarding the site has been listed and submitted for review and discussion at the Preliminary Design Review.

#### PART IV

##### TECHNICAL PERFORMANCE

The following documents have been prepared and submitted that appropriately describe the progress of technical performance during this period:

1. Working drawing sheets 1 - 4 and 5 - 14
2. Quality Assurance Plan
3. Verification Plan
4. Verification Cross Matrix
5. Test data forms and equipment
6. Description of rationale - special handling
7. Hazard Analysis
8. Requirement for site data for system definition

More definite technical goals will be established after the preliminary design review has been held and schedules for prototype reviews have been set out and defined.

There have been no major obstacles in technical progress thus far.

## MONTHLY STATUS REPORT

PERIOD: NOV. 1, 1976 - NOV. 30, 1976

TO: Belton Jones, Jr.  
Contracting Officer  
Att.: AP 32  
Marshall Space Flight Center  
Alabama 35812

Report No. 2

December 5, 1976

Contract NAS 8 32247

### PART I

#### SUMMARY

During this period the Preliminary Design Review was held on November 19 at the offices of the Binkley Company in Warrenton, Missouri. A recap of this meeting is included in this report. The schedule for the Prototype Design Review and Quarterly Review meetings has been tentatively changed from December 17, 1976 to January 25, 1977. We are awaiting confirmation of this date from MSFC. Two technical directives and two RID's were received and responded to during this period. Schematic control plans have been prepared and submitted. Site data is needed to proceed with prototype design and update revisions to the schematic controls. Technical and management work has progressed satisfactorily through this period with no delays anticipated if site data is made available to us by December 31, 1976.

### PART II

#### CONTRACT STATUS

No Change.

### PART III

#### SCHEDULES

The scheduled date of December 17, 1976 for the prototype design review and the first quarterly review has been tentatively re-scheduled for January 25, 1977. Confirmation of the date has not been received or confirmed by the Contracting Officer.

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## Quality Control Plan

A completely revised quality control plan is being prepared in response to the RID dated November 19. This plan will be designed to incorporate all useful quality control methods presently used by The Binkley Company in their regular manufacturing process of existing products, however, specific procedures will be designed for solar collector manufacturing. This plan will be completed by January 15, 1977 in time for discussion at the quarterly review meeting.

## Verification Plan

Several points of this plan were discussed at the meeting of Nov. 19. Please refer to the recap of this meeting attached.

## Plans & Specifications

In response to TD #2 complete instrumentation schematics and control system drawings were prepared and submitted (our Transmittal #10). It was explained that these drawings will have to be revised to conform to site conditions when the locations are assigned. The specifications for the prototypes will be specifically written to conform to the site and job conditions.

## PART IV

### TECHNICAL PERFORMANCE

Following the meeting of Nov. 19 a meeting was held with Dr. J.C. Wilson, General Manager of Dupont Tedlar Division. It was held in our offices in New Orleans, Louisiana. Dr. Wilson clarified several points relative to the use of Tedlar and glazing technology in general. Of specific interest was that Dupont is manufacturing an improved tedlar product which will be in production by January, 1977. The product number is 400 X RB 160 SE. The specific improvement is in the life of the tedlar when used as the under-glaze in the collector. Dupont feels that the life expectancy can be up to ten years, and the material will also offer much better resistance to high temperatures that may be caused by occasional stagnation in a collector. Our order to Dupont for the tedlar for the prototype for this contract has been changed to this improved product. Other points that have been questioned about tedlar such as adhesive, shrinkage, vibration and ventilation were discussed in detail and our specifications for tedlar will be substantially improved as a result of this meeting.

We do not feel that there have been any new technical problems developed from the discussions and meeting during this month's operations. All matters that require attention or investigation are in process and no delay should result in the design work for the prototype final plans and specifications if we receive the site data on or before December 31, 1976.

It was intended to provide a bar chart of present and projected contract schedules prepared for this report, however, we were advised at the meeting on Nov. 19 that MSFC has a chart already designed which would be sent to us so that we could coordinate our planning with MSFC control methods. As of this date we have not yet received the bar chart but it is hoped that we can incorporate it in the next monthly report.

## PRELIMINARY DESIGN REVIEW

### MINUTES & RECAP

The meeting was held at Warrenton, MO in the offices of The Binkley Co. In attendance were:

Mitchell Cash	MSFC
Valmore Fogle	MSFC
Larry Bradford	MSFC
Steve Rolwing	Binkley Co.
Jules Jordy	SEECO
Walter Jordy	SEECO

The meeting opened at 8:30 A.M. with a general review of drawings and other data to be discussed and reviewed. The following topics were covered but not necessarily in the order written herein:

- NASA 1. With the inner tedlar serving as upper flow chamber surface its temperature will essentially equal the absorber surface temperature if reasonable heat transfer to fluid exists. This increases convective and radiation losses such that effectively a single cover configuration exists.
- SEECO 1. The questions of single or double cover, heat transfer, etc. will have to be answered by experiment. A test set up is now being built at the Binkley Factory and we intend to do additional research.
- NASA 2. Have performance analyses or tests been conducted to determine effectiveness of proposed design versus a similar design with metal flow chamber top/absorber?
- SEECO 2. We have not made tests using a metallic flow chamber top absorber, as we feel that this is a distinct change from the preliminary prototype design upon which we were awarded the contract. We will certainly experiment with this down the line when time permits.
- NASA 3. Have potential problems concerning flutter of tedlar by air flow been observed and/or investigated?
- SEECO 3. No particular problems with air flutter of the Tedlar has been observed from running Prototype II now operating at Warrenton. Actually the expected design flow velocity for air will be much less than that now being used.

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- NASA 4. Additional details of collector insulation are requested.
- SEECO 4. Collector insulation will be applied in different ways at different site installation configurations. Other than those sample installation drawings which have been submitted, we have no other specific types of insulation in mind that is proven to be better than the type specified.
- NASA 5. A schematic of the entire system would be very helpful in understanding the various component functions and operation in the system. Also, control sensors, valves, etc., should be noted on schematic.
- SEECO 5. Schematics of the entire system will be submitted. We also will submit a preliminary instrumentation plan showing control sensors, dampers, etc., however, this will have to be revised to conform to requirements of specific site conditions.
- NASA 6. Collector testing should be done in accordance with ASHRAE Standard 93-P. Since it is an improved version of the NBSIR 74-635, the 93P document is expected to become the industry standard very shortly. Qualifying single 3'x16' panel will not tell them anything about ganged panel pressure drop, or effects of ganged panels as the overall collector efficiency.
- SEECO 6. Collector will be tested in accordance with ASHRAE standard 93-P. We are testing the 3'x16' module for our own information about optimum flow velocity. After we build entire 16'x36' module we will test as required.
- NASA 7. Qualification Plan per RID #2
- SEECO 7. Qualification Plan will be developed per RID #2.
- NASA 8. Don't understand what they mean by "backer"
- SEECO 8. Discussions of the backer film were had with Rolwing of Binkley. He promised to furnish further data on this polyester film's resistance to higher temperatures.
- NASA 9. Don't see any info regarding absorber plate coating. What is it? What are its optical properties? How stable is it? What are its off-gassing properties? Who makes it? Where are the spec. sheets on it?
- SEECO 9. We plan to use the CaldwellC-1077-3 paint. This has been approved by NASA. It has an asborbance value of about 0.90 and an emittance factor of apprximately 0.30. This is made Caldwell Chemical Coatings, Fayetteville, Tennessee.

This information was furnished in our modified proposal prior to contract award.



- NASA 10. It looks like you are qualifying the collectors, but what about their overall system.
- SEECO 10. Our overall system will usually depend upon the type of heating system already installed or specified for the building. This sub-system will always be a conventional type of hot air furnace of standard manufacture which normally does not need further qualification.
- NASA 11. Absorber paint not identified.
- SEECO 11. Commercial Identification. Black Paint: Caldwell Chemical Coatings, Fayetteville, Tennessee, 'Caldwell C-1077-3'.  
Application Procedure - Specification.  
Caldwell C-1077-3 Black Paint  
1. Degrease surface with iron or zinc phosphate.  
2. Apply C-1077-3 to obtain coating thickness of 0.3-0.5 Mil.  
3. Bake at 300-350°F for 15-20 minutes.  
Durability & Performance Degradation. Tests to date have indicated the following. Black Paint: Highly resistant to moisture and salt spray, no apparent thermal degradation at temperatures approaching 400°F. No long term degradation tests have been conducted.
- NASA 12. What is filler?
- SEECO 12. We do not know what material we will use for filler and heat isolator. We have written to several insulation manufacturers and Mr. Fogle has promised to give us the name of the NASA materials man who can help us choose an acceptable material.
- NASA 13. How effective is the silicone sealant (polyester foam type?) against rain intrusion under high wind loads. What tests will be performed to assess leakage?
- SEECO 13. The polyester foam strip has been used to protect against rain by the Binkley Company in their steel buildings for many years. Testing for leakage will be provided in our quality control system.
- NASA 14. Thermal Isolator - What is it made of? Where are the specs. on this material?
- SEECO 14. See above under "filler"
- NASA 15. Tedlar Film - We have no assurance that SEECO knows how to handle Tedlar.
- SEECO 15. We have had many years of experience with Tedlar since 1958 when we used it to build solar collectors in the Canary Islands. We are also working very closely with Dr. Wilson, the head of the Dupont TEDLAR technical division in Wilmington, Delaware.



NASA 16. What are their procedures for applying Tedlar sealing, and shrinking? What adhesive are they using? Also how will they control adhesive film thickness when they apply it to the glazing frame?

SEECO 16. Unfortunately the one who asked these questions did not read our proposal as we very minutely described all processes used in the application of the Tedlar to our collector, covering several pages.

We are using Monsanto GELVA adhesive as recommended both by NASA MSFC and by the Dupont Company Laboratories. The control of adhesive thickness will be done in any way that Dupont recommends. They suggest gauged hand rollers at this time.

NASA 17. What testing have they done?

SEECO 17. Considerable testing has been done today by the Dupont laboratories in Florida and in Wilmington. The Reynolds Co. has also been manufacturing and testing this application of Tedlar at their Torrance, California, plant for many years. We visited the plant and have been corresponding with Dave Laudig, the Manager, for several years.

NASA 18. What stagnation tests have been done on the double Tedlar to assure no failure occurs?

Double Tedlar is a no-no. Inner glazing will fail under long stagnation temperature soaking.

Frankly, I would not permit them to use Tedlar as an inner glazing unless they can submit long-term proof that a failure will not occur to the inner film. They should either consider tempered glass or perhaps FEP "Type B" Teflon since it can be bonded to the steel glazing frame. Ventilating the collection in the summer may not suffice if there has been an undetected fan failure.

SEECO 18. Stagnation tests have been made by Reynolds, Dupont and Binkley. Failures are confined to extreme stagnation conditions. Neither Dupont nor we feel that double Tedlar is a "no-no" in our application if used in low temperature operation.

Dupont has tested Tedlar under many conditions and they feel that our application will not present any problems, at least up to five years of use. We feel that Tedlar is so comparatively inexpensive that we can afford to change the Tedlar frames and glazing every five years and still be better off.

- NASA 19. Pan-L-Rib absorber plate - Straight thru air flow will not provide very good heat transfer to the air. It probably could be improved greatly if they could rotate the rib channels perpendicular to the air flow to improve air turbulence. However, they may be so locked into their design that they can't make the change.
- SEECO 19. It will be impossible to place the PAN-L-Rib channels at right angles to the air flow. We intend to use small angle "spoilers" to interrupt laminar flow by causing turbulence.
- NASA 20. I assume by their drawings that they will use external insulation for the collectors. However, I see no info. on the type, thickness, or specs, nor do I see any info regarding edge loss or that any consideration has been given to this problem. In fact, I'm not sure from Dwg. S-12 whether they plan to insulate. In addition, I would think that 1" of rigid insulation in their Eave Header Duct is inadequate to minimize heat losses in this area. Seems like they need to do some homework on heat transfer.

If they don't plan to insulate the backside of the collector, I don't think that this heating system will be very efficient. It will also play havoc with the A/C during the summer.

- SEECO 20. The application of insulation will depend entirely upon the type of installation. We can assure you that final drawings for specific site installations will be very detailed. Our use of 1" rigid urethane foam for eave insulation is equivalent to 2-3/4" of rigid fiberglass insulation board in insulating value. (See ASHRAE Tables)

See above comments on insulation. We agree that there will be a problem with air conditioning during the summer and we can only make tests to determine if our plan of high velocity ventilation will be satisfactory to keep the attic plenum sufficiently cool during the summer. If not, our plan is to insulate the back side of the collector with rigid insulation panels secured with "Kwiklips".

## 21. GENERAL

A tour of the Binkley plant was made and there were discussions on methods of production, quality control and other aspects of manufacturing

Inspection of the prototype collectors that are existing on site at the Binkley plant was made with further discussion and explanation of the points brought out in the morning meeting.

A visit was made to inspect a solar house--a frame house that is under construction. This house is utilizing Binkley panels in its construction and solar heating system.

Discussion regarding the location of the test sites not yet finally selected by NASA could cause some delay in our over all schedule-- It was decided if test sites were made available by December 15 and the Prototype Design Review was re-scheduled to about January 25, 1977, we could maintain our projected schedule as stated in the Development Plan.

All RIDS and points of discussion would be acted upon and further developed and/or investigated to be incorporated in future design and development phases of the collectors and system.

The requirements and data that will be needed for the Prototype Design Review were discussed. Spare parts list was defined as any part that was not expected to have a 5 year life expectancy or any moving parts that may require replacement within five years.

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## MONTHLY STATUS REPORT

PERIOD: DEC. 1, 19676 - DEC. 31, 1976

TO: Belton Jones, Jr.  
Contracting Officer  
Att: AP 32  
Marshall Space Flight Center  
Alabama 35812

Report No. 3

Jan. 7, 1977

Contract NAS 8 32247

### PART I

#### SUMMARY

Due to delays in finalizing site locations assignments only limited progress was made during the past month. The prototype design review originally scheduled for Dec. 17, 1976 in the development plan was rescheduled by the contracting officer to February 8, 1977. This will reflect a six week lag in our program as indicated on the bar chart projection attached.

The Quality Assurance Plan has been completely revised during this period in response to RID of Nov. 19, 1976.

Construction of a test module collector and test stand was begun in early December, however, due to inclement weather and holidays, has not yet been completed. Completion of the complete unit is expected by January 15, 1977. Weather permitting preliminary testing and data gathering will commence. Testing equipment to be installed in the test stand has been ordered and some of the instruments have been received.

Material and equipment acquisition is proceeding as anticipated; no delays are anticipated in this area.

### PART II

#### CONTRACT STATUS

There has been no change in the contract status since last report.

### PART III

#### SCHEDULES

Due to the delay in receiving the site assignments the Quarterly Review and the Prototype Design Review was necessarily rescheduled to February 8, 1977, the agreed date for the next meeting. This report would normally have been the Quarterly Report and it is therefore assumed that a Quarterly Report would be made after the Prototype Design Review has been completed.

A bar chart has been prepared to schedule the entire contract and is attached to this report. This schedule has been up-dated to conform to present projections and established dates.

#### QUALITY CONTROL PLAN

A completely revised Quality Assurance plan has been developed during the past month and has been submitted for approval with our Transmittal No. 12 dated January 5, 1977. It is noted that this Quality Assurance Plan deals only with matters pertaining to manufacturing and testing of the collectors and it is understood that a supplement to this plan will deal primarily with the installation procedures, materials and components. This cannot be prepared until after the sites have been assigned and specifications prepared.

#### VERIFICATION PLAN

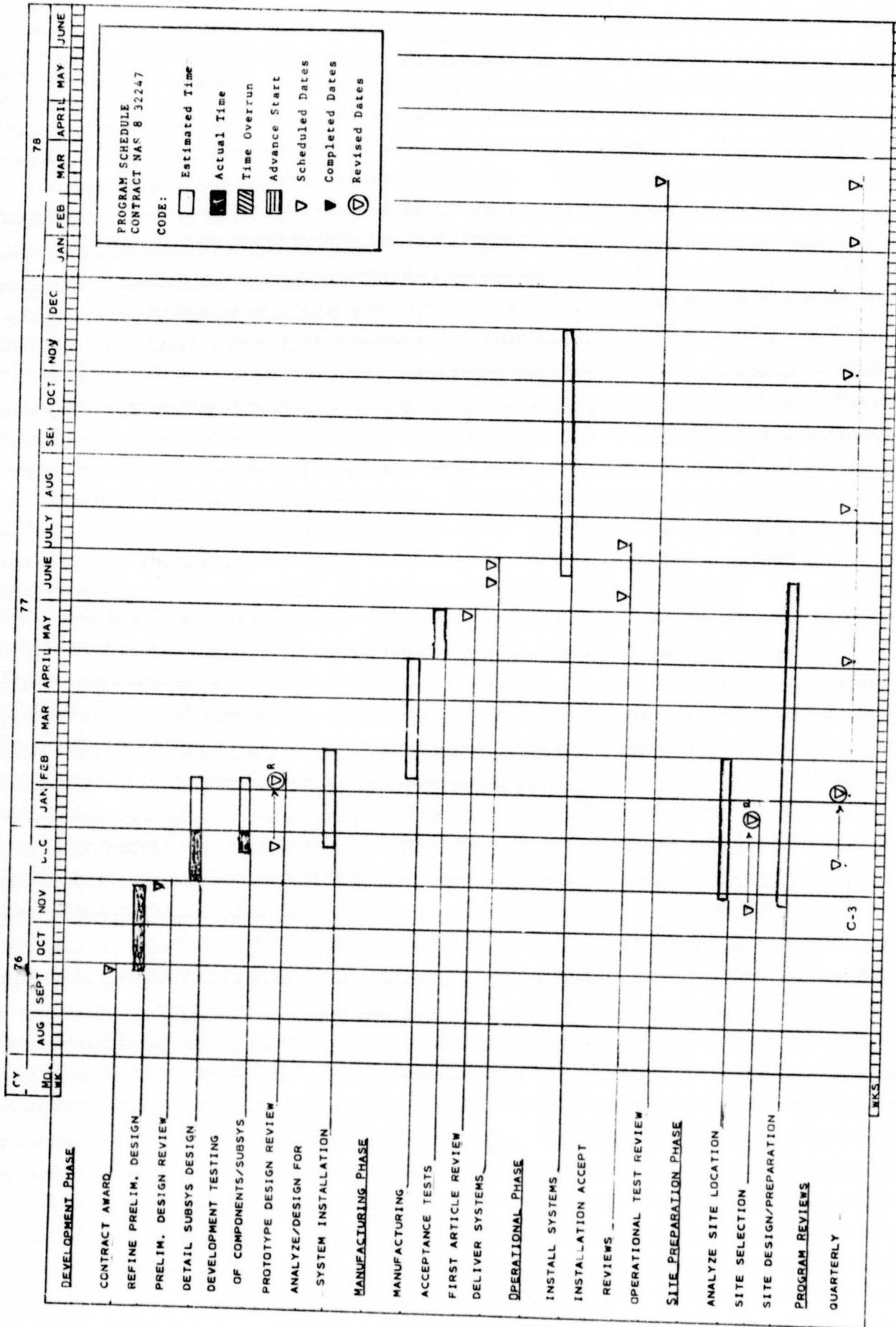
No work has been performed on this plan during the past month.

#### PLANS & SPECIFICATIONS

No additional work has been done on the plans and specifications during the past month. No work can proceed in this area until the site assignments have been made.

#### TECHNICAL PERFORMANCE

During this period construction was begun on the test stand in Warrenton, Missouri. The unit is not yet complete due to inclement weather conditions, however, it is anticipated that it will be ready for performing preliminary tests during the second week in January. There are several areas of performance and design that can be resolved with these preliminary tests and therefore will affect the writing of specifications for the prototype equipment. We will have this necessary testing done in time for the Prototype Design Review scheduled for February 8, 1977.



## MONTHLY STATUS REPORT

PERIOD: JAN. 1, 1977 - JAN. 31, 1977

TO: Belton Jones, Jr.  
Contracting Officer  
Att: AP 32  
Marshall Space Flight Center  
Alabama 35812

Report No. 4

Feb. 4, 1977

Contract NAS 8 32247

### PART I

#### SUMMARY

The prototype design review will be rescheduled for late March, probably the week of March 21. This is necessary to allow for procedural matters to be handled with the Bureau of Indian Affairs and NASA--for Site No. 1 in El Reno, Oklahoma.

Completion of a test module at the Warrenton, MO plant was further delayed due to extreme weather conditions. Weather permitting, testing can commence during first week in February which will provide ample test data for prototype design specifications.

Structural and Architectural designs for the El Reno site were submitted for review.

Further investigation for the use of TEDLAR was made as a follow-up on a report of Reynolds Aluminum Co.'s experiences with this material. Tedlar remains an acceptable material for use for our programmed temperatures.

### PART II

#### CONTRACT STATUS

No Change

### PART III

#### SCHEDULES

A revision in overall schedules will be necessary due to difficulties in finalizing site locations and procedural matters involved in finalizing details with the owner/management departments of the US Government Agencies responsible for the sites. The site in El Reno, Oklahoma requires coordination with the Bureau of Indian Affairs for the architectural and structural changes. An unscheduled trip to Albuquerque, New Mexico will be made to review the architectural and structural changes with the Bureau of Indian Affairs. It is hoped



that this meeting will help to expedite the program schedule, however, even with this conference scheduled the earliest date we can expect to have the prototype design meeting will be the week of March 21. No changes will be made in the bar graph projections except the date of the prototype design review date. Manufacturing and acceptance testing will be delayed, however, every effort will be made to make up time so that testing can be done before Spring and the ambient temperatures get too high for low temperature test information.

#### QUALITY CONTROL PLAN

No change since last report.

#### VERIFICATION PLAN

No change since last report..

#### PLANS & SPECIFICATIONS

We received the design plans for the El Reno residences--preliminary design for the installation of the collector on this building were submitted for owner's review. Final design will be prepared after preliminary approval is received from Bureau of Indian Affairs.

#### TESTING - Component sub-system

The extreme weather conditions in the St. Louis area for the past 30 days has made it impossible to complete the test structure. However, a prototype collector has been completed and testing can proceed on this test unit as soon as weather permits. Sufficient data from these tests will be available in time to utilize the data in the prototype design. It is expected that much of the test data will be produced in extreme cold weather conditions which will be valuable data in the event the actual prototype module cannot be completed before the end of winter and low temperature tests are not possible.

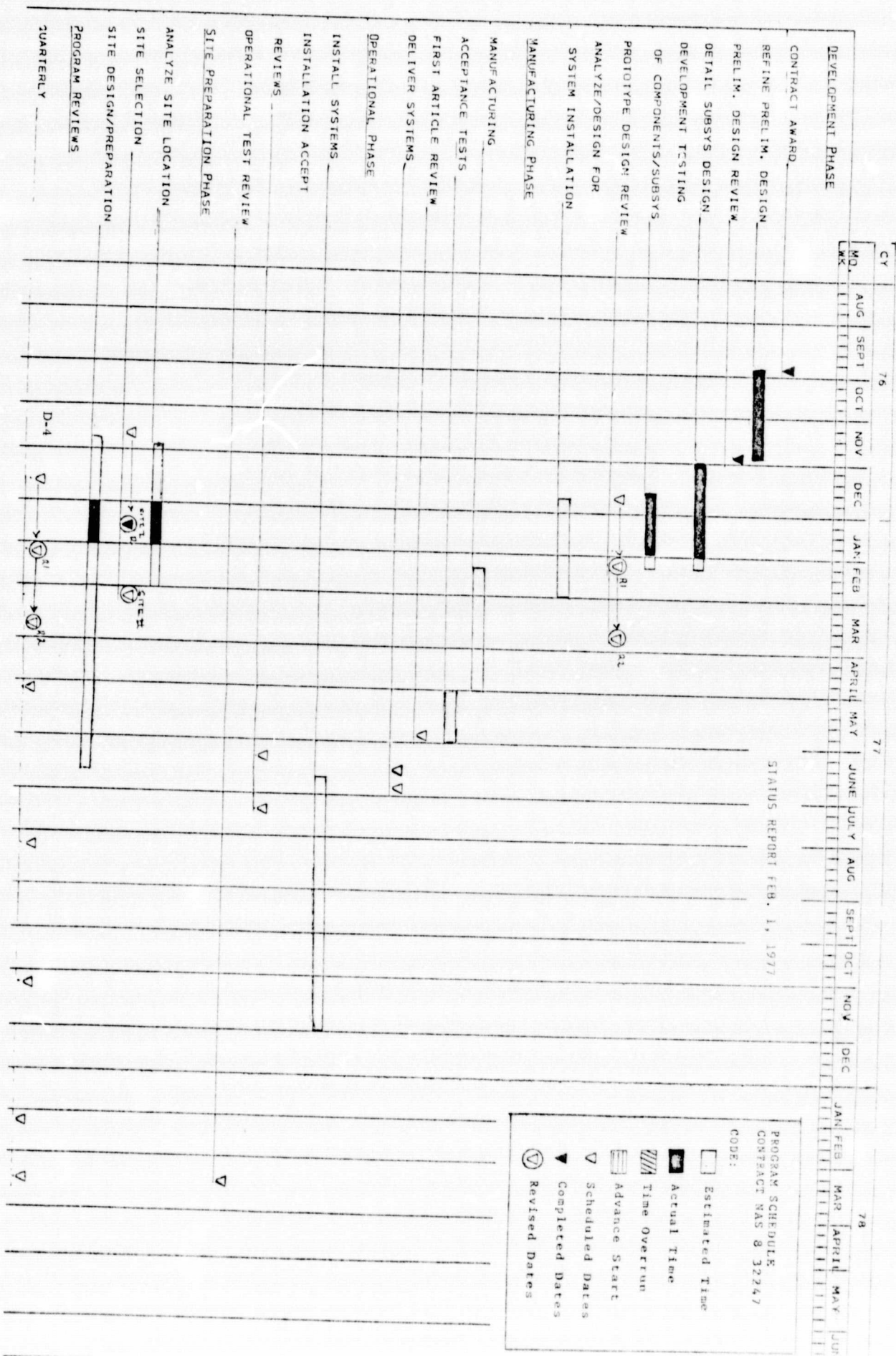
#### SITE DATA

Plans and details for Site No. 1--El Reno, Oklahoma have been and is undergoing design preparations (see schedules). We have not received any data for Site No. 2 as of this writing.

#### TECHNICAL PERFORMANCE

Further investigation was made on IEDLAR after receiving a report that Reynolds Company was experiencing more problems with Tedlar on their collectors. Telephone conversations were held with the Reynolds technical staff and with Dupont on the problem and it

was reported that the failures occurred at high temperatures (250° and higher) for extended periods. Our collector will operate in the 150 degree range with sensor alarm signals to alert mechanical failures that might cause extended stagnation. Our letter of January 26 provides a full report on this matter.



## MONTHLY STATUS REPORT

PERIOD: FEB. 1, 1977 - FEB. 28, 1977

TO: Belton Jones, Jr.  
Contracting Officer  
Att: AP 32  
Marshall Space Flight Center  
Alabama 35812

Report No. 5  
March 9, 1977  
Contract NAS 8 32247

### PART I

#### SUMMARY

Continued working on Site No. 1--El Reno, Oklahoma, with Bureau of Indian Affairs. Scheduled meeting in Albuquerque, New Mexico was attended in an effort to resolving architectural and engineering design and retrofit with Bureau of Indian Affairs for Site No. 1.

The construction of the test module was completed and instrumented for test procedures. Testing continued throughout the period.

Valuable technical and design information was obtained by attending the ERDA Flat Plate Collector Conference in Orlando, Florida.

Design plans for prototype No. 1 are substantially completed with exception of storage design. Storage location (above ground or under ground) not yet resolved by Bureau of Indian Affairs.

### PART II

#### CONTRACT STATUS

No Change

### PART III

#### SCHEDULES

Continued negotiations with the Bureau of Indian Affairs regarding Site 1, El Reno, Oklahoma. The Contract Schedule is dependent on resolving the assignment of this house and the time involved in retrofit modifications. At the present time it appears that our schedule date for Prototype Design Review will again be extended probably into early April.



## QUALITY ASSURANCE PLAN

A revised Quality Assurance Plan was submitted on January 15, 1977 in response to RID 2 dated 11/17/76.

## TESTING

The construction of the test module was completed and positioned for testing in Warrenton, Missouri during this past month. Our Engineer, Jules J. Jordy and Ted McCabe were on hand to conduct the initial test and to install the testing equipment, however several mechanical difficulties were encountered in these initial tests, the most annoying was the fluctuating electrical current providing electricity of the blower which connected to the manufacturing plant causing fluctuations in air volume through the collector whenever the fabricating plant made a heavy demand on the electrical circuit. This problem has been corrected by putting in a direct line to the collector. Attached is an efficiency curve of the collector on these initial tests which indicate that the collector is performing adequately. We will continue testing and recording and making various modifications to the test module to gain information on the reaction to the variety of changes. Reports on all tests will be provided at the Prototype Design Review Meeting.

## SITE DATA

Site No. 1 (El Reno, Oklahoma) is still being negotiated with the Bureau of Indian Affairs and as of this writing has not been finally assigned. Our Engineer, Jules Jordy went to Albuquerque, New Mexico to meet with the Bureau of Indian Affairs regarding the architectural and structural modifications to the building. Attending this meeting was Mr. Val Fogel of NASA and Mr. George W. Morgan of the Bureau of Indian Affairs. Basic approval was obtained for the design we had submitted, however, an additional meeting was tentatively scheduled for early March at the site where other interested members of the Bureau of Indian Affairs would attend and hopefully finalize resolution of the problems. On February 16 we prepared and submitted a tentative cost proposal of the modifications and installation of solar equipment. This proposal was merely an estimate to establish some budget range and was in no way final.

Site No. 2 has not been selected or assigned to us therefore no progress has been made with regard to this phase of the contract.

### TECHNICAL PERFORMANCE

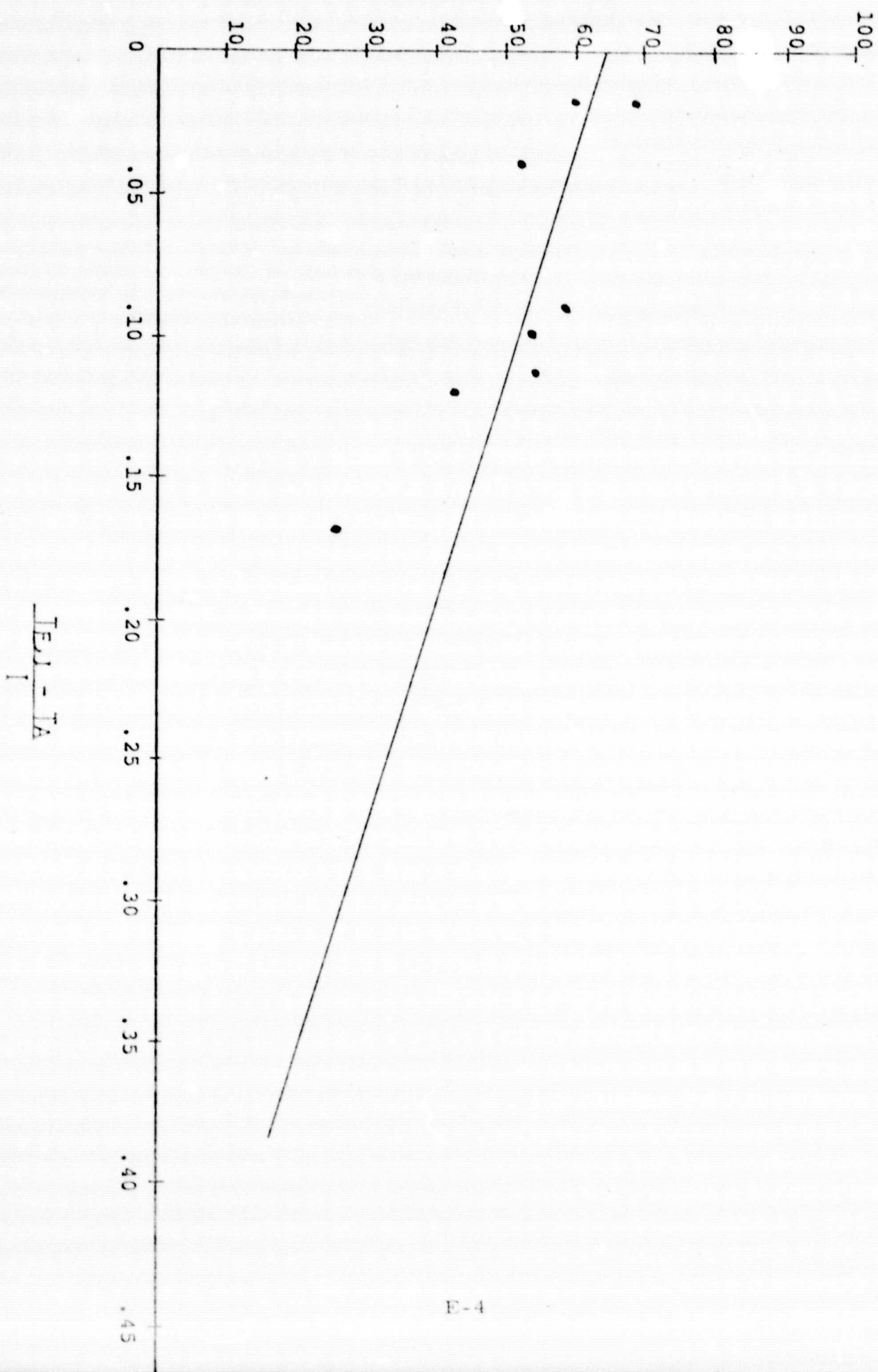
Our Engineer, Jules Jordy and the undersigned Project Manager, attended the Flat Plate Collector Conference in Orlando, Florida which was sponsored by the Florida Solar Energy Society and the ERDA. Of particular interest to us and this Contract were the sessions regarding the air-to-air systems, testing procedures and glazing materials. Again the problem of Tedlar's durability under stagnating conditions appeared in several of the conferences and considerable attention was given to Teflon for the inside glazing material which seems to be the superior product, however, cost and difficulty in manufacturing application of Teflon was a matter of concern to most of the manufacturers that have used it. We are following up on all aspects of the data obtained at the Conference and will provide reports as the information is evaluated.

### PLANS AND SPECIFICATIONS

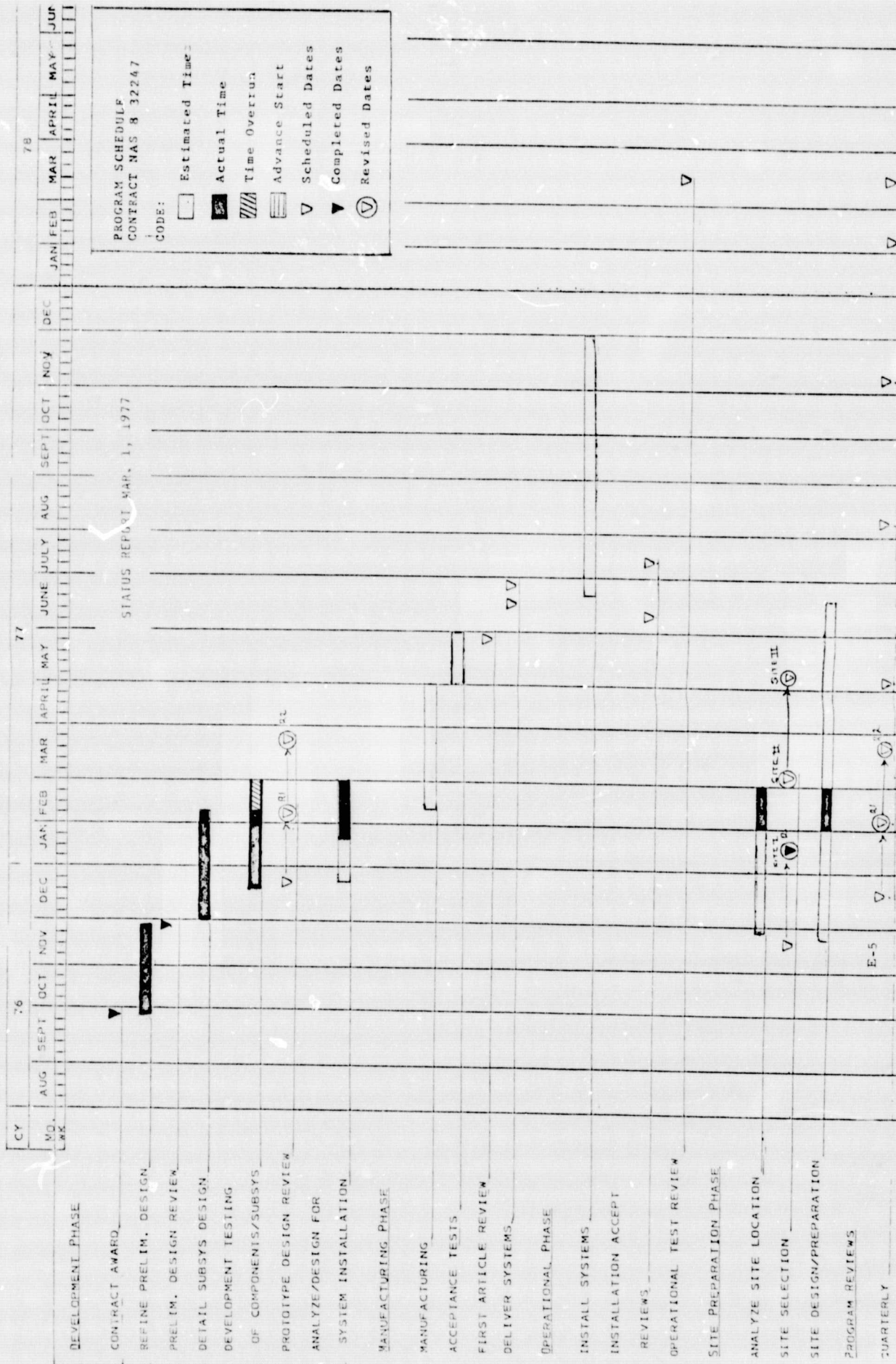
As discussed under the caption "Site Data" preliminary plans and specifications for prototype 1 have been in progress during this period, however, most of the work has been done with the collectors and the structural modifications. Very little work was done on the storage facility as it cannot be resolved whether the facility would be underground or surface. It is expected that this will be resolved at the next meeting at the El Reno site.

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# COLLECTOR EFFICIENCY







## MONTHLY STATUS REPORT

PERIOD: March 1, 1977 - April 30, 1977

TO: Claude W. Dorning  
Contracting Officer  
Attn: AP 32  
Marshall Space Flight Center  
Alabama 35812

Report No. 6

May 3, 1977

Contract NAS 8 32247

### PART I

#### SUMMARY

During the period a revised Development Plan and Milestone Schedule was submitted and approved.

The prototype design review was held on April 18-19 in Warrenton, MO. Substantial approval of the prototype was made and the production of the collectors is to proceed to meet the schedule of June 30 for the first Article Review.

We were advised that Site No. 2 was tentatively selected in Lincoln, Nebraska. Site review has not yet been scheduled.

### PART II

#### CONTRACT STATUS

Contract Modification No. 1 was submitted on March 15 and subsequently approved. This Mod. changed the Milestone Schedule and the payment schedule but did not change the contract amount. The Mod was necessary due to the delays experienced in the assignment of the sites thus affecting the progress payments also the development plan schedule had become distorted and a more realistic schedule needed to be established that would reflect the contract progress and projections.

### PART III

#### SCHEDULES

The Prototype Design Review was held on April 18-19 in Warrenton, MO at the Binkley plant.

As stated in the Contract Status above the Milestones

were re-scheduled as follows:

<u>Milestones</u>	<u>Site I</u>	<u>Site II</u>
Authority to Proceed	0	0
Design Data for SDAS	11-19-76	None
Preliminary Design Review	11-19-76	None
Quarterly Review	12-17-76	12-17-76
Prototype Documentation	3-28-77	6-30-77
Prototype Design Review(s)	4-15-77	7-15-77
Quarterly Review	5-6-77	N/A
Instrumentation Required for SDAS	5-15-77	7-15-77
First and Second Article Reviews	6-30-77	8-30-77
Quarterly Review	7-30-77	N/A
Delivery and Installation	7-30-77	9-30-77
SDAS Required	7-30-77	9-30-77
Installation Review	8-2-77	TBD
Site Tests and Final Drawings	8-30-77	10-30-77
Quarterly Review	11-10-77	N/A
Operational Test Review	3-15-78	3-15-78
Winter Tests 10/1/77 to 3/30/78		
Final Documentation	4-1-78	4-1-78

#### PART IV

##### DATA REQUIREMENTS

All data requirements and documentation for the prototype design review were prepared and submitted as follows:

- a) Design drawings
- b) Operation design calculations
- c) Operation Mode control Instructions
- d) Procurement specifications
- e) Spare Parts
- f) System Performance Specifications
- g) Test Data
- h) Verification Status Summary

All of this data submitted was reviewed at the meeting.

In attendance were:

Mr. Valmore Fogel	FA 32 MSFC/NASA
Mr. Larry Bradford	EP 45 MSFC/NASA
Mr. Jules Jordy	SEECO - Engineer
Mr. Walter Jordy	SEECO - Project Mgr.
Mr. Steve Rolwing	Binkley - Manufacturing Mgr.
Mr. Ev Robert	Binkley - President



The Prototype design was approved for fabrication with minor modifications recommended - covered under Specific RIDS.

These RIDS will not delay the manufacturing of the collectors as they applied primarily to the site system design of storage and operation modes which will be revised and submitted in ample time to incorporate the changes in design. June 30 is the scheduled date for the first Article review.

### TESTING

The Tests as performed on the test module were reviewed and some discussion was had on the curve data points. Additional test data will be accumulated during the next 60 days to further verify the performance curves.

## PART V

### SITE DATA

Site No. 1 - CONCHO SCHOOL, El Reno, Oklahoma.  
This site has been approved by the Bureau of Indian Affairs. It was resolved that the BOIA would request bids on the structural modifications to the building. SEECO prepared the base design drawing modifying the roof. The cost of this modification would be borne by BOIA and not made part of NASA's contract. The cost of the actual solar system will be determined by negotiating separate sub-contracts by SEECO. The total cost will determine the change order amount. Attempts were made to negotiate a total installed cost for the solar system but the proposed prices were exceptionally high and seemed out of line therefore it was agreed to have SEECO take separate bids in order to get the price within a reasonable budget figure. Several days were spent in the El Reno and Oklahoma City area soliciting sub bids by SEECO and the results look favorable in getting the cost of the installation down. A final cost of the change order will be submitted to NASA within the next week.

Site No. 2 - A site in Lincoln, Nebraska has been selected-- an observation building owned by the City of Lincoln, however final reviews, approvals and acceptance has not yet been made of the site.

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## QUARTERLY REPORT

PERIOD: May 1, 1977 - September 30, 1977

TO: Claude W. Dorning  
Contracting Officer  
Attn: AP 32  
Marshall Space Flight Center  
Alabama 35812

Report No. 7

Nov. 17, 1977

Contract NAS 8 32247

### PART I

#### SUMMARY

During this period the first article review was held at the Binkley Plant on July 6th, 1977. Shipment of the first article was scheduled for delivery to the Concho Site for August 5. Actual work on the Concho site was begun on August 1 making the necessary preparations for the delivery of the collectors, duct work and building the storage pit. The collectors were delivered on schedule on August 6th and the installation of all the components of the system proceeded throughout this period. During this period the contract was modified to cover the cost of installation of the system at both Sites I and II.

### PART II

#### CONTRACT STATUS

Contract Modification Supplement No. 2 was negotiated and approved on September 30, 1977. The modification made specific adjustments in the contract to cover the installation of the two systems at both sites and changing the Milestones to adjust to the actual projected schedules of deliveries and installation.

### PART III

Part III has been deleted.

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#### PART IV

##### DATA REQUIREMENTS

All documentation and data requirements were reviewed at the First Article Review meeting on July 6th with certain modifications and corrections being recommended. The recommendations were followed and revised documentations were made conforming to the RIDS. Considerable attention was given to the operating mode controls and descriptions with several additional sensing probes and automatic control dampers being added to the system. Final modifications to the documentation will be made to reflect these additions and modifications.

#### PART V

##### SITE DATA

The BOIA awarded a contract to do the structural modifications to the Concho residence. Work on this contract progressed satisfactorily and the building was ready for the solar installation by the August 6th delivery date of the collectors.

Confirmation of Site II in Lincoln, Nebraska was previously received and work was begun to modify the structure for the collectors and the total system. A working agreement was made with the General Contractor, Sampson Construction Company, to handle the direct on site work using his sub contractors for the different phases of work. Delivery of the collectors was made and the scheduled date for the first operational test was set for October 15, however, delay was encountered with the duct work sub contractor and therefore this schedule of October 15 will not be maintained. At this writing

the tentative schedule is now November 15 to 30 for final operational test.

The next Quarterly period ending December 31, 1977 should be the final report for both sites with the exception of SDAS operations for Site 11. A complete overview of the contract will be prepared for the final report.